

**Remarks**

By this amendment, claims 1, 3, 8, 9, 12, 13, 15, 16, 19, and 20 are revised to address the comments appearing on page 2 of the Office action. Claims 1-21 remain pending. No claims have been cancelled or added.

No new matter is added. Claims 1, 8, and 15 are amended to show “°C” as the temperature unit. The use of this unit will be apparent from a reading of the detailed description, wherein “°C” is the unit used.

Reconsideration of the application, as amended, is requested.

**Rejections under 35 U.S.C. 112**

It is believed that the foregoing amendments address all the stated issues regarding the wording of claims 3 and 8-21.

**Rejections under 35 U.S.C. 103**

All the pending claims stand rejected as allegedly being obvious from some combination of publications including Ruff et al (5,066,472) in view of WO 03/033115 (using Hirano et al, US 2004/0258596 as unofficial English translation) and Terry et al (3,900,312).

Applicant respectfully disagrees.

The presently claimed methods proceed, without the formation of a liquid waste product, by combining two solids: (1) a flowable solid material that includes at least one low volatility, water-reactive metal chloride and (2) a powdered hydrate.

HCl is released from the water reactive metal chloride without forming an aqueous HCl phase. As explained in the specification, this is quite significant because it avoids having to deal with corrosive liquids.

The cited publications do not show or suggest reacting a flowable solid material that includes at least one low volatility, water-reactive metal chloride with a powdered hydrate as claimed by applicant.

With regard to the cited publications, Ruff '472 does not teach hydrolysis by heating a combination of two solids. Instead, Ruff '472 teaches the addition of significant amounts of water vapor and HCl to a residue. For example, claim 1 of Ruff '472 calls for:

“treating the remaining residue with water vapor at a temperature of 100° to 300° C. in the presence of additional hydrogen chloride in amounts of 10 to 40 wt.-% with respect to the hydrogen chloride and water mixture . . .”

And at Col. 3, Lines 47-54, Ruff '472 gives the example:

“The same distillation residue as in the above Comparison Example was reacted by the method of the invention. For a period of 18 minutes, 150 kg of the pre-dried residue was treated with a stream of 152.1 kg/h of steam at a temperature of 170° C. to which 185.8 kg/h of a mixture of hydrogen chloride and water vapor, corresponding to an azeotropic composition of **hydrochloric acid** of 20.4 wt.-% of hydrogen chloride, was added.” (emphasis added)

Ruff '472 thus fails to teach a system that avoids corrosive liquids.

WO '115 (using Hirano et al, US 2004/0258596 as unofficial English translation) does not teach hydrolysis by heating a combination of two solids and does not fill the gaps of Ruff '472. WO '115 describes a treatment of hot acid gases, not solids as is called for by the claims of the present application. Claim 1 of US 2004/0258596 reads:

A method for removing a halogen series gas, which comprises **contacting a gas** containing a halogen series gas forming at least one kind selected from the group consisting of HF, HCl, HBr and HI by water with a granule containing from 60 to 99.9 mass % of a solid base and from 0.1 to 40 mass % of a carbonaceous

material to the total mass amount of the granule **in the presence of water**.  
(emphasis added)

The treatment proposed by WO '115 will not operate in the presently claimed processes because it presupposes that the acid reagent is one of the halogen gases. Such is not case with the presently claimed invention. In the present invention, there are no halogen gases present, nor any other volatile components.

There is also no liquid water. The presently claimed processes employ water that is chemically bound to a solid (or is loosely bound to a weak adsorbent) such that only by heating ( $>80^{\circ}\text{C}$ ) is the water released as water vapor, not as liquid water. The water vapor so released *in situ* can easily migrate throughout and/or penetrate into the water reactive flowable solid.

The water vapor released from the hydrate of the present invention serves as a volatile transfer agent. There is no aqueous phase into which any of the halogen gases or water reactive chlorides can dissolve and ionize. The absence of an aqueous phase capable of ionizing by-product HCl means that this process may be conducted in an iron-containing vessel without the vessel corroding from exposure to the  $\text{H}^{+}$  ion. Because there is no aqueous phase, there is no acid corrosion. The present process thus is unique in its ability to "neutralize" a water reactive solid in a vessel that is not acid-resistant.

With the presently claimed processes, any HCl which is released can flow out of the system as a gas in a substantially anhydrous state, and does not form a condensed aqueous phase. Any such evolved HCl gas can be neutralized in a device such as a scrubber or adsorber.

In WO '115, halogen gases react with the base which is co-present with adsorbent granules. In the processes of the present invention, if there is any neutralization reaction between the solid base and halogen gases, it is purely happenstance and trivial. Such a reaction

does not play a significant part in the presently claimed processes, which simply are intended to render metal chloride containing solid waste material suitable for disposal.

Terry '312 does not add anything to teach or suggest hydrolysis by heating a combination of two solids. The cited claim 5 of Terry refers to a "process for producing aluminum in essentially elemental form" by a specific process which is not subject matter related to the presently claimed invention.

The cited publications simply do not show or suggest a process for releasing HCl from a water reactive metal chloride without forming an aqueous HCl phase. Being able to do this and to convert the water reactive flowable solid to a non-reactive (neutral) state in an anhydrous manner, so as not to corrode ordinary, iron-containing vessels, is a significant step forward.

All the pending claims also stand rejected as allegedly being obvious from some combination of publications including Breneman et al (4,743,344) in view of Keller et al (3,878,291), WO '115 (using Hirano '596 as an unofficial English translation) and Terry '312.

Breneman '344 does not teach hydrolysis by heating a combination of two solids. This patent is only significant in that it describes a metal chloride residue. The cited passage of Breneman '344 (Col. 2, lines 62-66) describes treatment with a hydrocarbon such as kerosene, which has nothing to do with the presently claimed processes.

Keller '291 does not teach hydrolysis by heating a combination of two solids, including hydrate to release water vapor *in situ*. The cited passage of Keller '291 (Col. 5, Lines 50-57), describes an external source of water:

"While retaining the direction of rotation of the paddle dryer 14 after drying off the solids has taken place, **steam is blown in through conduit 50** for hydrolysis. The **hydrogen chloride set free is absorbed in water** and returned to the process (not shown)." (emphasis added)

It seems clear from that passage that Keller '291 does not contemplate a process for operating in vessels that are not acid resistant.

For the reasons discussed above with regard to the first rejection under 35 U.S.C. 103, WO '115 and Terry '312, whether taken alone or together, fail to provide a teaching that fills the gaps left by the teachings of Breneman '344 and Keller '291.

In sum, the cited publications, whether taken alone or together, fail to suggest the presently claimed methods which are able to proceed, without the formation of a liquid waste product, by combining two solids, including a water-reactive metal chloride from which HCl is released without forming an aqueous HCl phase.


The claims as amended should be allowed.

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